

1. General

Purpose	The purpose of this document is to provide a standard approach for reporting measurement uncertainty estimates and conformance with specifications. It is especially important to report measurement uncertainty when a measured value, bound by its uncertainty, encompasses a specified limit.	
Scope	<p>This procedure defines the standard approach to be used when reporting uncertainty and conformance with specifications. This procedure applies to category IV test methods within the scope of accreditation as defined by QP-001: Estimating Measurement Uncertainty.</p> <p>Current affected methods under the scope of accreditation:</p> <p>Note: List test methods that are included under the scope of accreditation or UL Client Test Data Program.</p>	
Definitions	Uncertainty	The unknown difference between a measured result and the actual value.
	Calibration Uncertainty	The uncertainty associated with the calibration standard or master used while performing a calibration. Generally, this is the expanded uncertainty estimate at 95% confidence. Confidence may also be stated in terms of the coverage factor, $k=2$.
	Resolution	The finest increment of change that may be observed on an instruments scale.
	Repeatability	A statistical value (typically 1 standard deviation) calculated based on the results of repeated measurement.
	Combined Uncertainty	A calculated statistical value using the root sum squared method, RSS, that includes all identified sources of uncertainty
	Expanded Uncertainty	Calculated uncertainty at the prescribed confidence interval. This procedure assumes ~95% confidence and identifies the expanded uncertainty as $U_{95\%}$.
Responsibility	Quality Manager	Maintain this procedure and uncertainty estimates of affected test methods.
	Test Personnel	Report results in accord with this procedure.

2. Procedure

- 2.1. Determine test method uncertainty base on QP-001: Estimating Measurement Uncertainty using the following assumptions:
 - 2.1.1. Calibration uncertainty is the most conservative estimate of all devices that could be used to perform the test. The most conservative estimate is based on the device with the highest expanded uncertainty.
 - 2.1.2. Resolution and thermal effects are neglected in determining test method uncertainty since they are already factored into the calibration uncertainty.
- 2.2. Compare the test or calibration result to the appropriate acceptance criteria.
- 2.3. Conformance may be determined when a measured value, bound by its uncertainty, does not encompass a specified limit. In this case, test results may be reported without uncertainty bounds.

2.4. Example of meeting requirements (Note: it may be appropriate to use an alternate example based on the specific needs of your lab):

2.4.1. Uncertainty of the extendible element pull force test is ± 1.6 -lbf.

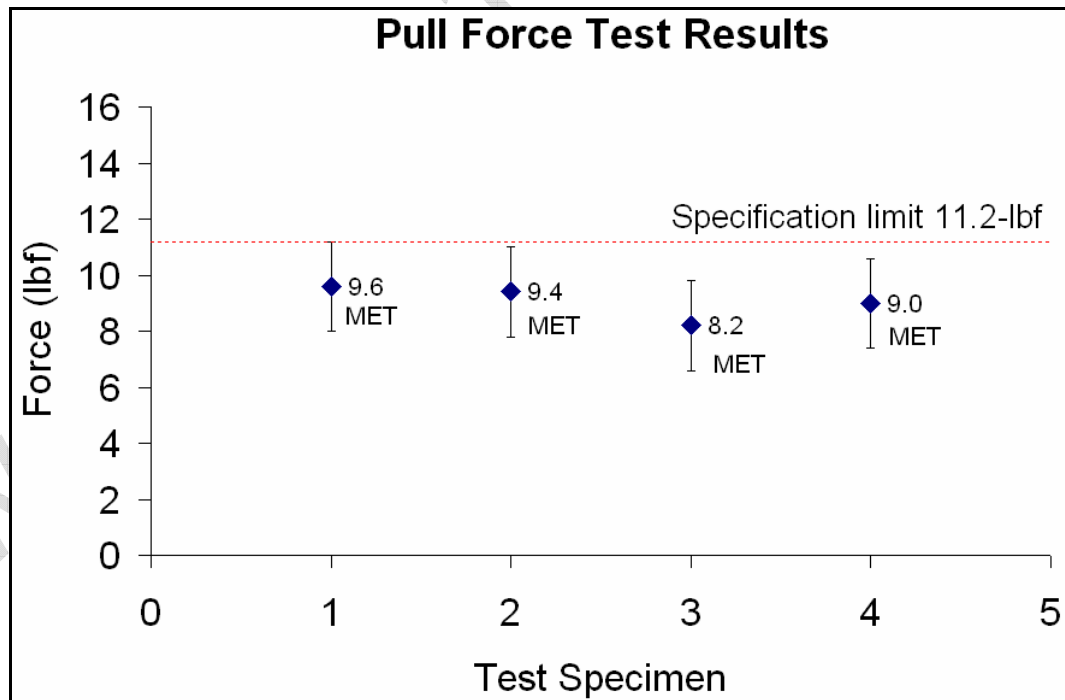
Pull force test data:

Specimen	Result	Lower	Upper
1.	9.6	8	11.2
2.	9.4	7.8	11
3.	8.2	6.6	9.8
4.	9.0	7.4	10.6

Acceptance Criteria:

The extendible element pull force shall not exceed 11.2-lbf.

Graphical representation:



2.4.2. In this example, all specimens clearly met the performance requirement.

2.5. Example of not meeting requirements:

Uncertainty of the extendible element pull force test is ± 1.6 -lbf.

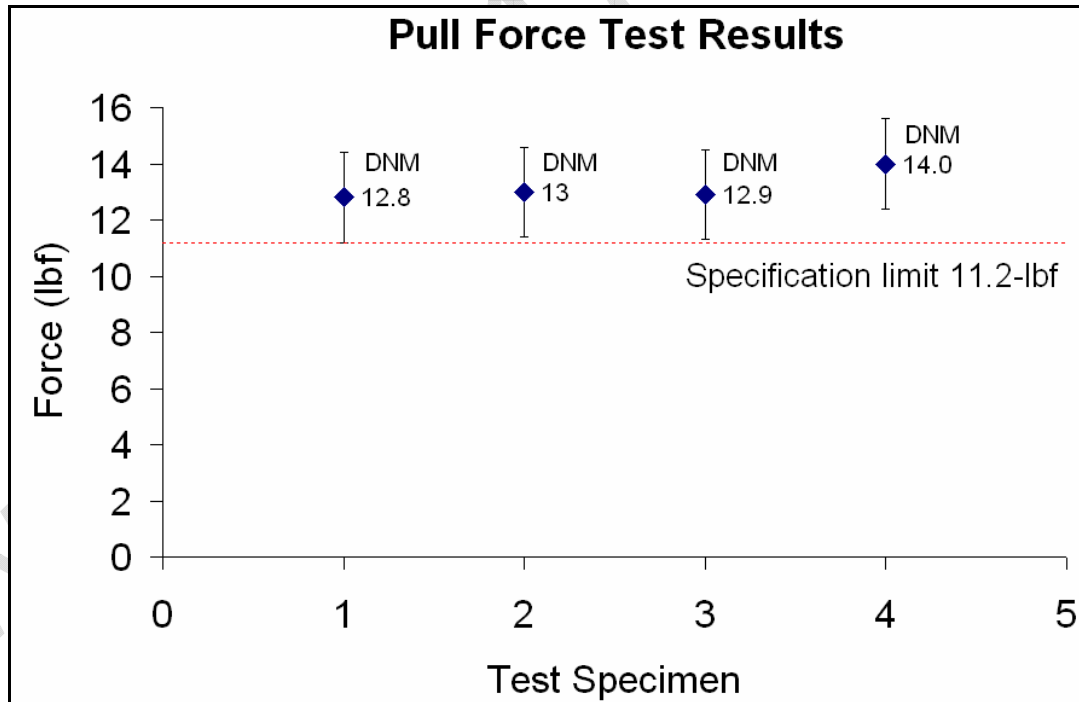
Pull force test data:

<u>Specimen</u>	<u>Result</u>	<u>Lower</u>	<u>Upper</u>
1.	9.6	8	11.2
2.	9.4	7.8	11
3.	8.2	6.6	9.8
4.	9.0	7.4	10.6

Acceptance Criteria:

The extendible element pull force shall not exceed 11.2-lbf.

Graphical representation:



2.5.1. In this example, all specimens clearly did not meet the performance requirement.

- 2.6. Conformance shall be determined according to the following decision rule when a measured value, bound by its uncertainty, encompasses a specified limit.

The measured value shall be compared to the acceptance criteria and reported as either MET¹ or DNM¹. The following note must accompany the summary:

Note:

1. The uncertainty of the measured result encompasses the specification limit. See test results for more information.

- 2.6.1. Example where conformance cannot be determined:

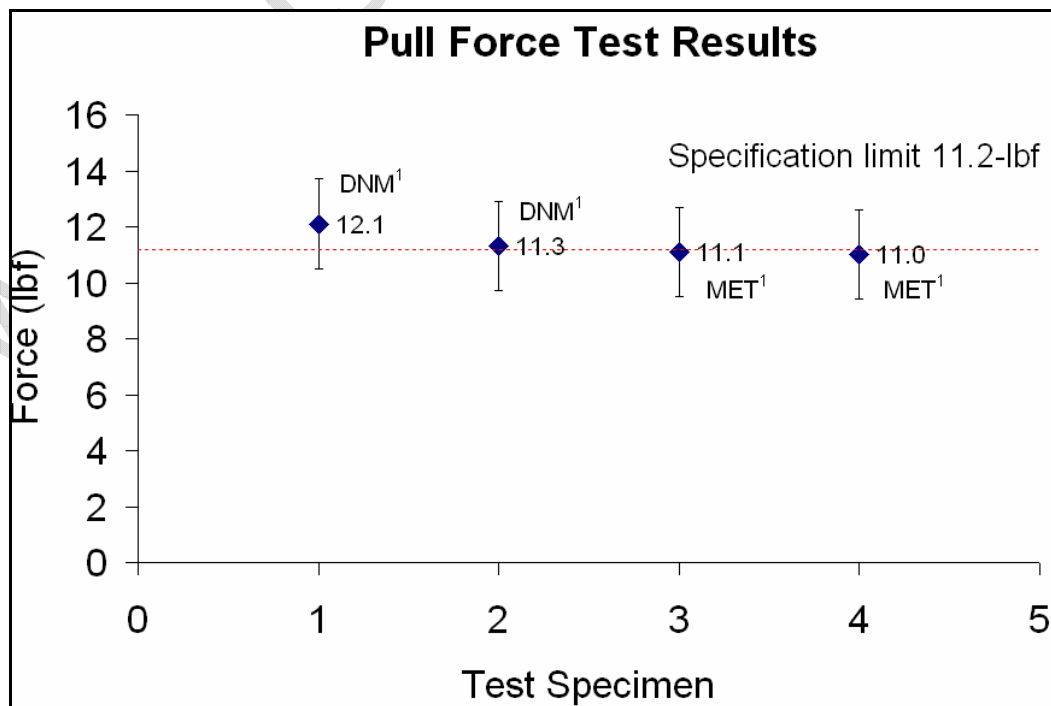
Uncertainty of the extendible element pull force test is ± 1.6 -lbf.

Pull force test data:

<u>Specimen</u>	<u>Result</u>	<u>Lower</u>	<u>Upper</u>
1.	12.1	10.5	13.7
2.	11.3	9.7	12.9
3.	11.1	9.5	12.7
4.	11.0	12.6	9.4

Acceptance Criteria:

The extendible element pull force shall not exceed 11.2-lbf.



- 2.6.2. In this case, specimens 1 and 2 did not meet the requirement and specimens 2 and 3 met the requirement. However, all results, when bound by uncertainty, encompass the specified limit of 11.2-lbf. Therefore, there is uncertainty as to whether the specimens did or did not meet the requirements.

2.6.3. The test results shall be reported as follows:

<u>Specimen</u>	<u>Result</u>	<u>Uncertainty at 95% Confidence</u>
1.	12.1	± 1.6-lbf
2.	11.3	± 1.6-lbf
3.	11.1	± 1.6-lbf
4.	11.0	± 1.6-lbf

2.6.4. Alternatively, if there is only one specimen, the result shall be reported as follows:

“The extendible element pull force was 12.1 ± 1.6 lbf at 95% confidence”

3. Change Control Section

<u>Version</u>	<u>Rev. Date</u>	<u>Change Control Comments</u>	<u>Approver</u>
1	07.30.2009	Created new document.	(approver name)